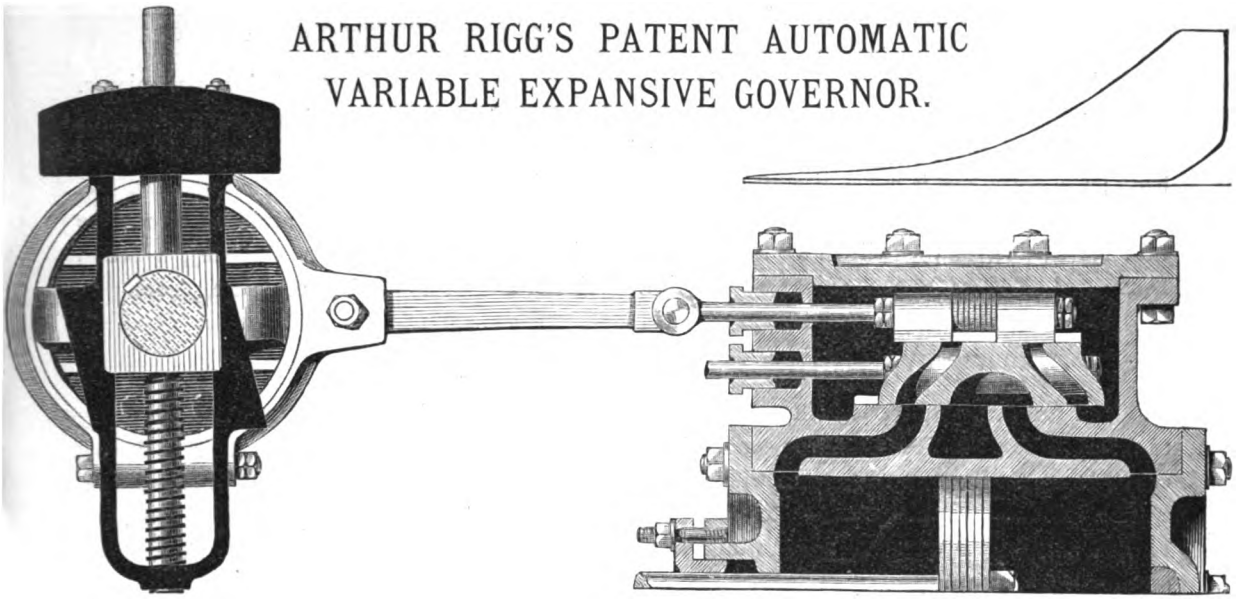


Variable Expansion under the control of a Governor is an essential element in any complete plan for securing the economical working of a Steam Engine; for even with an inconstant load this method admits only the exact amount of steam required at full pressure, and gains every possible advantage from its expansion.

The Patent Governor illustrated fulfils these objects in the simplest and most direct manner, and it can be applied with ease to existing Engines. There is a weighted frame sliding radially on the Engine Shaft, turning round with it, and controlled as to position by centrifugal force overcoming the resistance of a spring. Thus, the distance of the Governor Ball from the centre of Engine Shaft depends upon the number of revolutions per minute. Attached to the Governor Frame are Inclines, which fit against projections on an Expansion Valve Excentric, whose Stroke, variable by the Governor, regulates the expansion of steam within any desired limits; and this simple arrangement, consisting of only three or four parts, gives practically as good a result, and effects as great an economy in fuel, as the most complicated Governors known. This Governor can be seen at work in London.

All the Engines quoted in the following Tables are supplied with these Governors, and capable of working to a pressure of one hundred pounds per square inch; all above 6 horse-power have Steam-jacketed Cylinders, Felted and Lagged, they are supplied with extra heavy Fly-Wheels and every requisite for a first-class Engine, and they run steadily with a high rate of expansion.

Feed Pumps not supplied with the Engines unless specially ordered.

Higher power can be got than given in the Table below, but it is not recommended.

HIGH-PRESSURE BRIGHT HORIZONTAL STEAM-ENGINES.

Nominal Horse-power.	Indicated Horse-power.	Diameter of Cylinder.	Piston Stroke.	Price.	Nominal Horse-power.	Indicated Horse-power.	Diameter of Cylinder.	Piston Stroke.	Price.
		inches.	inches.	£			inches.	inches.	£
4	16	6	7	80	10	40	10	15	160
5	20	7	10	90	12	50	12	18	190
6	25	8	14	110	16	65	14	20	240
8	35	9	15	135	20	80	16	24	300

ARTHUR RIGG,
ENGINEER, 1, FENCHURCH STREET, LONDON, E.C.

SPECIAL ENGINE FOR EXPORTATION.

This Engine has an 8-inch Cylinder with 24-inch Stroke, and makes 60 Revolutions per minute. It is supplied with an ordinary Governor and Throttle Valve, Feed Pump and Water Heater, a special Disengaging Gear for stopping instantly, and it is so arranged as to be erected either right or left hand; the Fly Wheel is 8 feet diameter, heavy, and made in halves for convenience of transport.

The Boiler is self-contained, 10 feet long and 4 feet 6 inches in diameter, arranged to reverse with the Engine, and supplied with all necessary Fittings, and a Wrought-Iron Chimney, a Steam Dome, and all Pipes for connections with Engine. Price of Engine and Boiler, complete, £400.

CONDENSING AND COMPOUND ENGINES.

Good Condensing Engines will produce the same horse-power with about half the coal necessary to drive the best High-Pressure Non-condensing Engines, and this will always repay their additional cost. These Engines are all supplied with ARTHUR RIGG'S PATENT VARIABLE EXPANSION GOVERNOR, a set of Slide and Expansion Valves to each Cylinder, both of which are Steam Jacketed, Felted, and Lagged, and each Engine is supplied with a Donkey Pump or Injector: but there is no Feed Pump on the Engine unless specially ordered.

COMPOUND CONDENSING STEAM-ENGINES.

Nominal Horse-power.	Indicated Horse-power.	Diameter of High-pressure Cylinder.	Diameter of Low-pressure Cylinder.	Length of Stroke.	Engine with Air Pump and ordinary Condenser.	Surface Condenser extra.
		inches.	inches.	inches.	£	£
25	80	9	15	20	450	65
35	100	10	18	24	560	100
45	150	12	20	30	700	150

None of the Prices include packing, which averages about 5 per cent.

Boilers amount to about the same price as Engines, but special quotations will be given on application.

WINDING ENGINES.

The smaller sizes arranged to run at a high speed and drive a Drum by Worm and Worm Wheel. This system avoids the necessity for Brakes, enables the Drum to be stopped instantly, and ensures safety.

Price of Winding Engine with Two 7-inch Cylinders, Reversing Gear, Worm Wheel and Drum complete .. .. } £200

Estimates for other sizes on application.

MARINE ENGINES,

Simple or Compound, to run at high speed without vibration, driving an Improved Patent Screw-Propeller, and provided with Patent Turning Gear, which avoids any difficulty in starting, or any irregularity in motion.

PUMPING ENGINES,

For Mines, Quarries, &c., and other purposes.

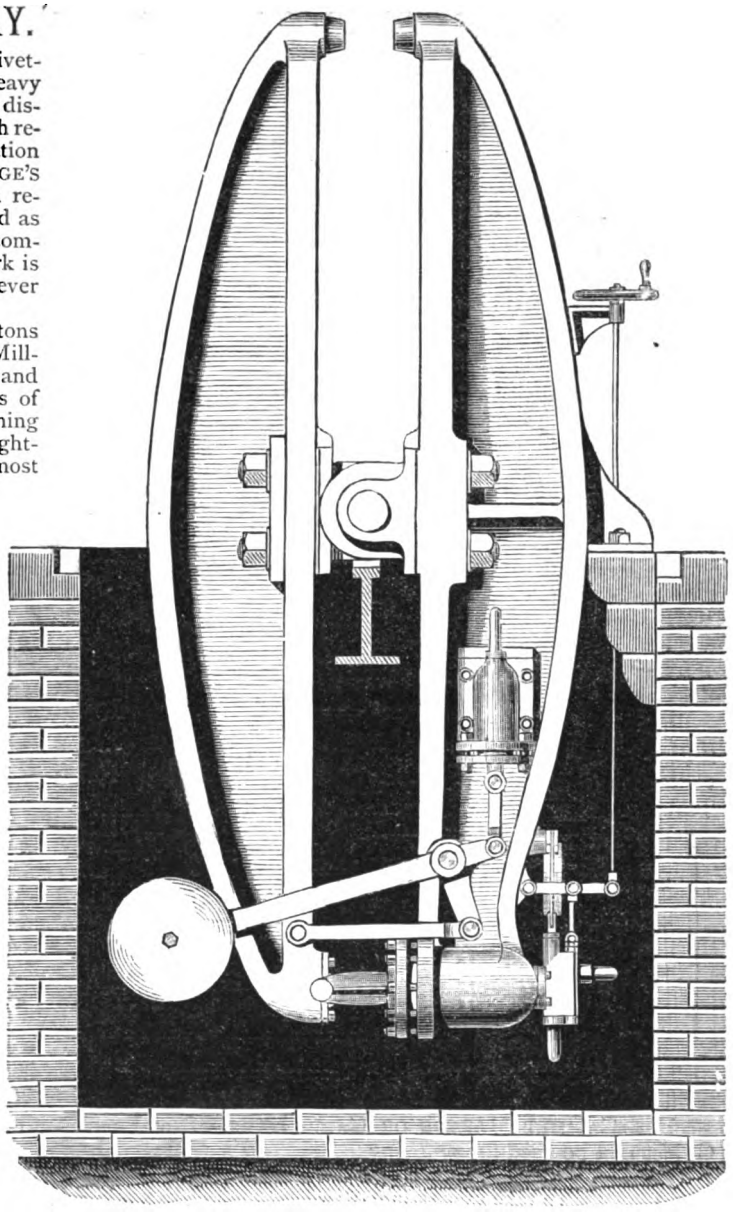
ARTHUR RIGG,
ENGINEER, 1, FENCHURCH STREET, LONDON, E.C.

HYDRAULIC MACHINERY.

For mechanical processes, such as Riveting, Shearing, Punching, &c., where heavy pressures are required through short distances, hydraulic power can be applied with remarkable ease and economy. The illustration shows Messrs. McKay and MacGeorge's Patent Hydraulic Riveter, which requires only unskilled labour to work it, and as the Plates are held together and Rivets compressed to fill their holes entirely, the work is done both cheaper and better than is ever possible by hand.

One of the largest Machines, giving 60 tons on the Rivet, can be seen working at the Millwall Docks Engineering Works, London, and it is used for rivetting the heaviest class of marine-boiler work, and also for straightening or bending ships' beams and heavy wrought-iron work. This application renders it a most useful machine in any shipbuilder's yard.

In order to economize power, a small ram first brings the dies together and full pressure comes on the larger ram, thus the work is done with less than half the power required for a Steam Rivetter.



SPECIAL MACHINES ARRANGED EITHER FIXED OR PORTABLE.

ARTHUR RIGG'S PATENT HYDRAULIC PUMPS.

These Pumps have one Ram and two Valves only, and give a continuous stream. They may be used to fill an accumulator or to supply Hydraulic Presses. A Disengaging Apparatus can also be applied to throw the Pump out of action when the Accumulator is full, and start again as it descends.

SPECIAL HYDRAULIC MACHINERY.

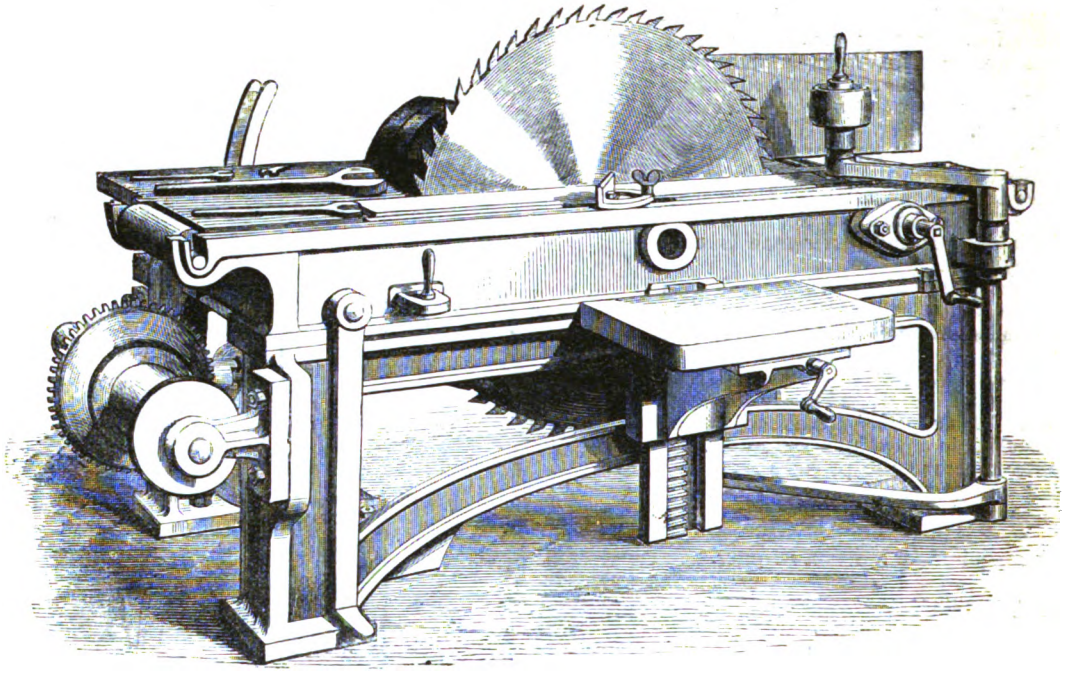
Presses for making Lead Pipes, for extracting Oil, and compressing Paraffine or Gunpowder; Accumulators of a new design; Hydraulic Rams and Pumps of all kinds; Centrifugal Pumps or Scoop Wheels for raising Water; and any other kind of Hydraulic Machinery.

MESSRS. McKAY AND MACGEORGE'S PATENT HYDRAULIC RIVETTER,
MANUFACTURED BY ARTHUR RIGG, ENGINEER, 1, FENCHURCH STREET, LONDON, E.C.

Diameter of Rivet.		Pressure on Rivet.	Depth of Gap Opening.	Rivetter and Beam Bender.	Accumulator and Pump for working Two Machines.
For Girders.	For Boilers.				
inch.	inch.	tons.	inches.	£	£
¾	⅝	30	54	250	200
1¼	1	45	54	300	230
1¾	1½	60	60	450	300

ARTHUR RIGG,
ENGINEER, 1, FENCHURCH STREET, LONDON, E.C.

CIRCULAR-SAW BENCH.



This Saw Bench is unusually massive and well suited for rough, heavy work. It may be driven by Steam, or by Water Power with Turbines; but Water Wheels are less suitable for the purpose. For Colonial use, and where a vertical fall of not less than 50 feet is available, the combined Saw and Turbine will be found the cheapest and best arrangement.

Diameter of Saw.	Spindle, Pedestals, and Pulley.	Circular-Saw Benches.			Combined Bench and Turbine.	
		Plain Bench, extra.	Self-acting Feed, extra.	Boring Table.	Spindle and Pedestals and Turbine.	Plain Bench and Turbine.
inches.	£	£	£	£	£	£
24	10	25	15	13	50	72
36	12	35	15	15	70	94
42	15	40	20	17	88	112

Screw Keys included: packing extra. Pipes for Turbines, Saws, or holding-up Rollers extra.

SPECIAL SAWING MACHINERY.

FOR CABINET MAKERS OR CARPENTERS.—Saw Bench with Elevating Table, Parallel and Bevel Guides can be used for grooving.

To take in an 8-inch Saw, and may be driven by hand £10
To take in a 15-inch Saw £48

Moulding and Boring Apparatus may be applied to the larger Machine.

FRET SAW.—An admirable self-contained machine for cutting out Ornamental Scrolls, &c.:

To take 4 inches Thick and 13 inches Radius £35
To take 6 " " 33 " £45

FOR ESTATES OR TIMBER MERCHANTS.—*Circular Saws*, with Travelling Wrought-Iron Tables, Self-acting Variable Feed, Quick Return Motion, and Boring Table.

Frame Saws.—Balanced to run at high speeds, with Adjustable Silent Feed Motion, and driven by Steam Power, or direct by Turbines having not less than 10 feet vertical fall.

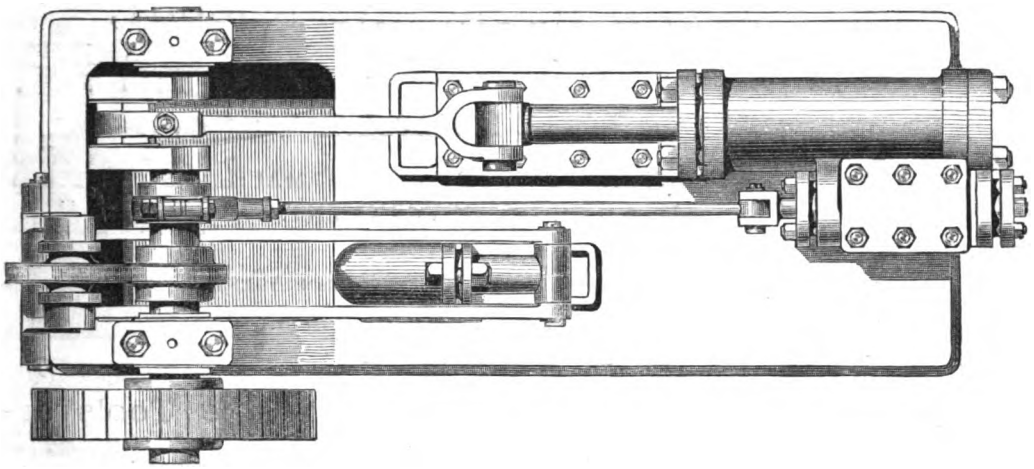
FOR ENGINEERS.—*Band Saw* for cutting Metals more cheaply and better than can be done by any other method. With 30-inch Pulleys, £100.

FOR SLATE QUARRIES.—*Circular-Saw Tables* for cutting Slate Slabs, with self-acting independent Feed and Quick Return Motion. A very superior and powerful Machine.

Table 11 feet by 5 feet £60
Table 12 feet by 6 feet £95
} No Saws included.

ARTHUR RIGG,
ENGINEER, 1, FENCHURCH STREET, LONDON, E.C.

HYDRAULIC ENGINES.



For very high pressures Hydraulic Engines are generally more desirable than Turbines, and in such cases Water Wheels are wholly inapplicable. Also wherever power is required at various places in a large area it is more economical to convey it by high-pressure Water Pipes than by Shafting or any other method, notwithstanding the necessity for pumping the supply for Hydraulic power by a central Engine.

Another useful application of Hydraulic Engines is where an abundant Waterfall exists at an inconvenient place for establishing a mill, or as in the manufacture of Gunpowder where Steam power may be dangerous. In any of these cases high-pressure water may be pumped, conveyed, and used to drive Hydraulic Engines.

All working parts of the Patent Hydraulic Engine illustrated are made of gun metal in the Engines marked A, but a cheaper Engine is made with cast-iron working parts, and prices for it are given under the heading B, and it consists of one Cylinder and Slide Valve only: uniform rotary motion being secured by a Cam and Compensating Roller. The Slide Valve used is applicable to any other Hydraulic Machinery, and its faces do not cut with clean water however high the pressure.

PRICE LIST OF PATENT HYDRAULIC ENGINES.

Diameter of Cylinder.	Length of Stroke.	A To work up to 1000 lb. per Square Inch. Gun Metal.	B To work up to 100 lb. per Square Inch. Cast Iron.	To 1000 lb. per Square Inch.	
				A Engine alone.	Engine, with Capstan and Platform.
inches.	inches.	£	£	£	£
2	6	35	26	65	110
3	9	50	35	90	155
4	12	80	60	150	230

TURBINES AND WATER WHEELS.

Turbines can be used for any fall of water, from 1 foot upwards, and they are made with Spindles, horizontal or vertical, and to work at the bottom of a fall or above it, either for a constant or variable load. They are not checked by tail water like Water Wheels, and they work noiselessly, and often for years together without repairs. These Turbines are provided with a Water Lubricated Footstep of improved construction, and are made of iron or gun metal.

COMBINED MILLSTONE AND TURBINE.—This useful arrangement consists of a Vertical Spindle, with a Millstone at its upper end and a Turbine below, and it costs from £100 to £200.

WATER WHEELS.—Specially arranged for exportation with Wrought-Iron Turned Shaft, Cast-Iron Shrouds and Pedestals, and Wooden Ventilating Buckets.

Prices quoted for Turbines or Water Wheels, Gearing, &c., on receipt of information: Vertical fall and quantity of water available, or horse-power required.

ARTHUR RIGG,
ENGINEER, 1, FENCHURCH STREET, LONDON, E.C.